Pearson
BTEC

Mark Scheme (Results)

January 2022

Pearson BTEC Nationals
In Applied Science (31627H1B)
Unit 5: Principles and Applications of Science II - Biology

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications website at http://qualifications.pearson.com/en/home.html for our BTEC qualifications.

Alternatively, you can get in touch with us using the details on our contact us page at http://qualifications.pearson.com/en/contact-us.html

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson. Their contact details can be found on this link:
http://qualifications.pearson.com/en/support/support-for-you/teachers.html

You can also use our online Ask the Expert service at https://www.edexcelonline.com
You will need an Edexcel Online username and password to access this service.

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your learners at: www.pearson.com/uk.

January 2022
Publications Code 31627HB_2201_MS
All the material in this publication is copyright
© Pearson Education Ltd 2022

Unit 5: Principles and Applications of Science II

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Marking grids should be applied positively. Learners must be rewarded for what they have shown they can do, rather than be penalised for omissions.
- Examiners should mark according to the marking grid, not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks, if the learner's response is not rewardable according to the marking grid.
- Where judgement is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific marking guidance

The marking grids have been designed to assess learner work holistically. Rows in the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band, depending on how they have evidenced each of the descriptor bullet points.

BTEC Next Generation Mark Scheme

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1 (a)</td><td>glomerulus/glomerular capillaries/knot of capillaries/capillaries/podocytes/basement membrane

Accept name if given on the diagram.</td><td>Accept phonetic spelling

Do not accept Bowman's capsule/ Malpighian body</td><td>1</td></tr>
<tr><td>1 (b)</td><td>
<table>
<tr><th>Region of nephron</th><th>Function</th></tr>
<tr><td>PCT</td><td>selective reabsorption/ (re)absorption of {glucose/amino acids/salt(s)/named ions/water}</td></tr>
<tr><td>A</td><td>ultrafiltration of blood</td></tr>
<tr><td>collecting duct</td><td>reabsorption of water</td></tr>
<tr><td>renal vein</td><td>carries blood away (from kidney/nephron)/
takes blood (from kidney) to {general circulation/heart/vena cava/main vein}</td></tr>
</table>
</td><td>1 mark per box

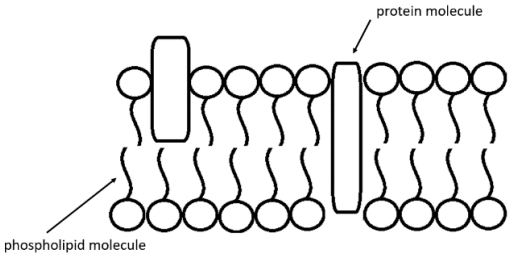
Ignore urea in a list
Ignore refs to methods of transport

Allow removes for carries

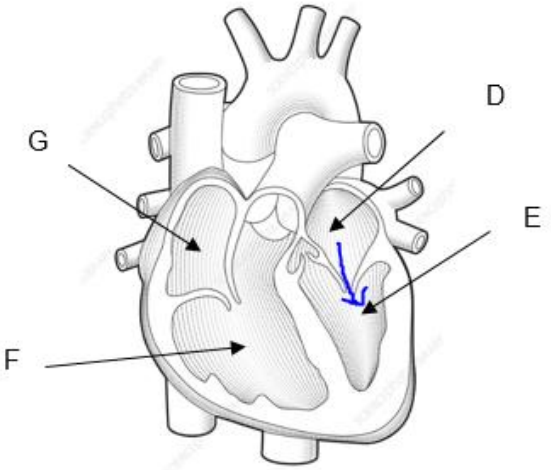
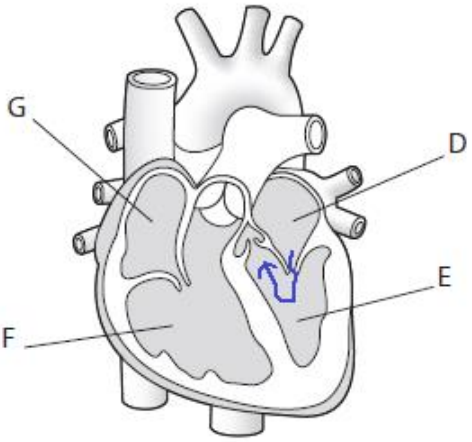
Accept carries {deoxygenated/deoxified/ purified/ filtered} blood</td><td>2</td></tr>
</table>

1 (c)	ADH/anti diuretic (hormone)/vasopressin	*Accept* adh accept phonetic spelling	1
1 (d)	*Award one mark for an identification point and one mark for an expansion point.* *Any one of the following could be an identification point, depending on how the learner shapes their response.* *Identification point:* (causes) high pressure/pressure difference (1) *Expansion points*: One of: (due to) bottleneck effect/description of (1) (aids) {squeezing/forcing/pushing} (small molecules/water/fluids/named small molecules or ions), from blood/into Bowman's capsule/into filtrate) (1)	*Accept* reference to smaller diameter increases resistance and creates force (Mp1) *Accept* any idea of blood going into a smaller space accept Blood enters faster than it can leave *Ignore* filtering Do not credit 'forcing cells out of blood'	2

1 (e)	B = salts/ions/electrolytes/named ions/salt (1) C = blood/blood vessels/capillaries/vasa recta (1)	*Ignore* solutes *Accept answers in the paragrap h 1 box* Accept renal vein but do not accept renal artery	2
1 (f)	*Advantage* *One from:* no need for dialysis/going to hospital (1) may have normal life (or description of)/healthy life/no need to diet (1) more cost effective (1) cures kidney failure/now have functioning kidney (1) living longer (1) *Limitation* *One from:* waiting list (1) shortage of donors (1) effect on a living donor (1) need to match (donor and recipient) (1) (any) risk from surgery (1) risk from anaesthetic (1) more susceptible to infections (1) risk of organ rejection/transplant could fail (1) need to take immunosuppressants/medication (1)	Accept an example of normal kidney function	2
		Total	**10 marks**

Question Number	Answer	Additional Guidance	Mark
2 (a)	D 		1
2 (b)(i)	X = osmosis/diffusion/facilitated diffusion Y = exocytosis/active transport	*Accept* phonetic spelling *Ignore* excretion	2
2 (b)(ii)	D osmoregulation		1
2 (c)	C For the movement of the contractile vacuole.		1

2 (d)	*Award one mark for an identification point and up to three marks for expansion points. Any one of the following could be an identification point, depending on how the learner shapes their response.* *Identification point:* (amoeba/it is) {single cell(ed)/small} (1) *Expansion points:* *Three from:* Large (enough) {surface area:volume ratio / SA/V} (1) (so) a lot of {membrane/surface} (compared to cytoplasm/compared to inside of cell) (1) short distance (1) for gases to diffuse (1) (can) meet {energy needs /needs for respiration/metabolic demand}/has low energy needs (1)	Accept Large surface Accept refs to channels (as they are therefore talking about membrane) Need diffuse here not gas exchange 'Short diffusion distance' = 2 marks Accept 'doesn't need so much oxygen to live/respire' Accept 'don't need as much {oxygen /energy} as a human' Accept idea that it is surrounded by water /gets oxygen from water	4
		Total	**9 marks**

Question Number	Answer	Additional Guidance	Mark
3 (a)	Any arrow(s) starting from D/entering D from pulmonary veins, and ending somewhere in E or passing into aorta  Or  	Ignore any arrows coming into LA from pulmonary veins Ignore arrows going out through aorta If draw arrows for both sides of heart = 0 marks	1

<table>
<tr>
<td>3 (b)</td>
<td>
<table>
<tr><th>chamber</th><th>thickness of muscle wall/mm</th></tr>
<tr><td>D</td><td>3</td></tr>
<tr><td>E</td><td>16</td></tr>
<tr><td>F</td><td>8</td></tr>
</table>
</td>
<td>Ignore any units in body of the table

1 mark per row</td>
<td>3</td>
</tr>
<tr>
<td>3 (c)</td>
<td>Award one mark for an identification point and two marks for expansion points.
Any one of the following could be an identification point, depending on how the learner shapes their response.

to allow atria to {finish contracting/to empty/finish systole/relax (1)

so blood {goes from atria into ventricles/goes through AV valves (1)

(to allow time) for valves to close/ to prevent backflow} (1)

before {ventricles start to contract/blood leaves heart/blood {pushed/pumped/forced} out of heart} (1)

If they have not gained any of the above marks they can have one mark for

So different parts of the heart contract and relax at the correct times/in the correct sequence/in the correct rhythm (1)</td>
<td>Allow pumping/ squeezing/ beating for contracting

accept ‘ensure ventricles contract after atria (1)

Allow:
So both A and V don’t contract at same time (1)

So top stops contracting before bottom contracts (1)

Lets blood pass through before being pumped out (1)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>7 marks</td>
</tr>
</table>

Question Number	Answer	Additional Guidance	Mark
4 (a)	A letter M		1
4 (b)(i)	volume used (1) 2 litres conversion (1) 2000 mL Division (1) 2000/70 Division (1) 28.57/60 OR volume used (1) 2 litres Conversion (1) 2000 mL Division (1) 2000/60 Division (1) 33.33/70	Correct answer of 0.476/0.48/ 0.5 gets 4 marks *Allow any number that rounds up to 0.5* ECF from their graph reading to max 3 Max 3 if they use 3000 ml so 0.71 on own = 3 marks Accept any number that rounds to 0.7 POT error 3 marks	4

4 (b)(ii)	*Credit one identification point and one expansion point. Any point could be an identification point depending on how the learner shapes their argument.* *Identification point*: increased muscle contraction/using muscles more/heart beats {faster/more} (1) *Expansion points*: (so) more {ATP/energy} needed (1) (so) (aerobic) respiration/respiration in mitochondria (1) (and) to {oxidise/get rid of/prevent build up of} lactic acid/prevent oxygen debt (1) (and) re-oxygenate myoglobin (1)	accept muscles work harder (1) accept named stage of aerobic resp e.g. Krebs/link ox phos/ electron transport chain accept pay oxygen debt **Total**	3 **8 marks**

<table>
<tr><th>Question number</th><th>Indicative content</th></tr>
<tr><td>5</td><td>

Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers.

<table>
<tr><th>feature</th><th>arteries</th><th>veins</th><th>capillaries</th></tr>
<tr><td>wall</td><td colspan="2">have walls made of three layers, (endothelium, tunica media and tunica externa)</td><td>one layer - endothelium</td></tr>
<tr><td>wall thickness</td><td>thickest</td><td>thinner</td><td>thinnest</td></tr>
<tr><td>smooth muscle</td><td>a lot (in middle layer of walls)</td><td>some/less than in artery walls (also in middle layer of wall)</td><td>none</td></tr>
<tr><td>collagen</td><td>present (in middle layer of walls)</td><td>none</td><td>none</td></tr>
<tr><td>elastin</td><td>a lot/more than in vein walls (in middle layer of wall)</td><td>some/less than in artery walls (in middle layer of walls)</td><td>none</td></tr>
<tr><td>endothelium</td><td>folded when not dilated</td><td>smooth</td><td>smooth</td></tr>
<tr><td>lumen size</td><td>smaller than that of veins</td><td>larger than that of arteries</td><td>very small/allows only one red blood cell at a time through</td></tr>
<tr><td>lumen shape</td><td>round</td><td>oval</td><td>round/oval</td></tr>
<tr><td>baroreceptors in walls</td><td>yes</td><td>no</td><td>no</td></tr>
<tr><td>valves</td><td>no (except for beginning of aorta and pulmonary artery – semi-lunar valves)</td><td>yes, semi-lunar valves</td><td>no</td></tr>
<tr><td>pulse</td><td>yes</td><td>no</td><td>no</td></tr>
</table>

Other valid responses should be credited

Allow other valid points such as:

- reference to fatty plaques/atherosclerosis developing in walls of arteries
- reference to walls of arteries producing nitric oxide
- reference to {gaps/pores/fenestrations} in capillary walls (especially in kidney glomerulus or lack of pores in brain capillaries/blood-brain barrier)

</td></tr>
</table>

Mark scheme (award up to 6 marks) refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
Level 0	0	No rewardable material.
Level 1	1–2	• Demonstrates adequate knowledge and understanding of scientific facts/concepts to the given context with generalised comments made. • Generic statements may be presented rather than linkages to the context being made so that lines of reasoning are unsupported or partially supported. • The comparison may contain some similarities and differences showing some structure and coherence.
Level 2	3–4	• Demonstrates good knowledge and understanding by selecting and applying some relevant scientific facts/concepts to provide the comparison being presented. • Lines of argument mostly supported through the application of relevant evidence drawn from the context. • Demonstrates some awareness of both similarities and differences leading to a comparison which has a structure which is mostly clear, coherent and logical.
Level 3	5–6	• Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of scientific facts/concepts to provide the comparison being presented. • Line(s) of argument consistently supported throughout by sustained application of relevant evidence drawn from the context. • The comparison shows a logical chain of reasoning which is supported throughout by sustained application of relevant evidence.

Total for Question 5 = 6 marks
TOTAL FOR PAPER = 40 MARKS

Ofqual
Llywodraeth Cynulliad Cymru
Welsh Assembly Government
Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom
Rewarding Learning